UNION SWITCH & SIGNAL
A member of the ANSALDO Group
5800 Corporate Drive, Pittsburgh, PA 15237

SERVICE MANUAL 6237A

Installation, Operation, Field and Shop Maintenance

Dual-Frequency TRU-II Code Reset Module

N451206-0301

August, 1993
A-8/93-3012
P&C MAC-II 6237A

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REVISION INDEX

Revised pages of this manual are listed by page number and date of revision.

PAGE NO.	REV. DATE

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SECTION I
GENERAL INFORMATION

1.1 INTRODUCTION

This manual describes the operation, installation and maintenance of the Dual-Frequency TRU-II Code Reset Module, US&S part no. N451206-0301. The module is designed for use with a TRU-II Track Resonant Unit (refer to service manual SM-6236) when the latter is applied in code overlay applications. When a track circuit shunt is released in a TRU-II code overlay arrangement, the module provides the release of the "V" (frequency control relay), allowing the TRU-II to reset with steady energy track feed. The module is a plug-in package designed for mounting on a standard relay rack configuration using a special mounting plate.

The Dual Frequency TRU-II Code Reset Module differs from the earlier Code Reset Module (part number N451206-02XX) in the following respects:

A. Operates at a second carrier frequency of 250 Hz

B. Provides reset capability for additional standard code rates of 270 and 420

C. Does not function as a vital device (refer to section 3.1)

D. Replaces all -02XX models with a single unit

1.2 SPECIFICATIONS

Dimensions:	H = 8", W = 2-3/8", D = 9-1/2"
Weight:	5 lbs.
Mounting:	Standard relay rack
Local Voltage:	110 or 120V ac ±10% @ 50, 60, 91.67 or 100 Hz
Local Current:	20 mA
Track Voltage:	10.0 to 30.0V ac +10% @ 91.67 and 100 Hz
Track Current:	9 mA @ 9V ac (energized state)
Dielectric Breakdown Voltage:	3,000V ac RMS, 60 Hz for one All terminals to chassis
Propulsion Power:	DC to 60 Hz ac
Frequency Immunity:	Reset will not energize: 25 Hz, propulsion, 150V ac 60 Hz, propulsion, 150V ac 250 Hz, signal, 125V ac

Maximum Code Rate:	420 code
Minimum Coder "On" and "Off" Time:	38%
Operating Temperature Range:	-40°C to +70°C

SECTION II
INSTALLATION
(See Figure 2-1)

WARNING

MAKE CERTAIN SIGNAL AND OPERATING POWER TO THE DUAL-FREQUENCY TRU-II CODE RESET MODULE REMAINS OFF UNTIL ALL INSTALLATION PROCEDURES ARE COMPLETE, OTHERWISE PERSONAL INJURY MAY RESULT.

2.1 EQUIPMENT RACK MOUNTING

NOTES

The Dual Frequency TRU-II Code Reset Module is available with rack mounting plate included (refer to Appendix A).

The TRU-II Track Resonant Unit and reset module must be mounted side-by-side.

1. If mounting the module on a US&S equipment rack, bolt the base plate in position.

2. Solder local signal lines (110-120V ac) to socket terminals 1 and 2 on the module.

3. Solder track lines (10V ac) to socket terminals 5 and 6 on the module.

4. Solder external signal wires for "V" relay control to socket terminals 3 and 4 on the module.

2.2 SHELF MOUNTING

When shelf mounting the TRU-II system, install a mini-rack with the required combination of track resonant unit, reset module, track relay and repeater relay. This rack has a resistor unit terminal block mounted in place next to the terminal strips.

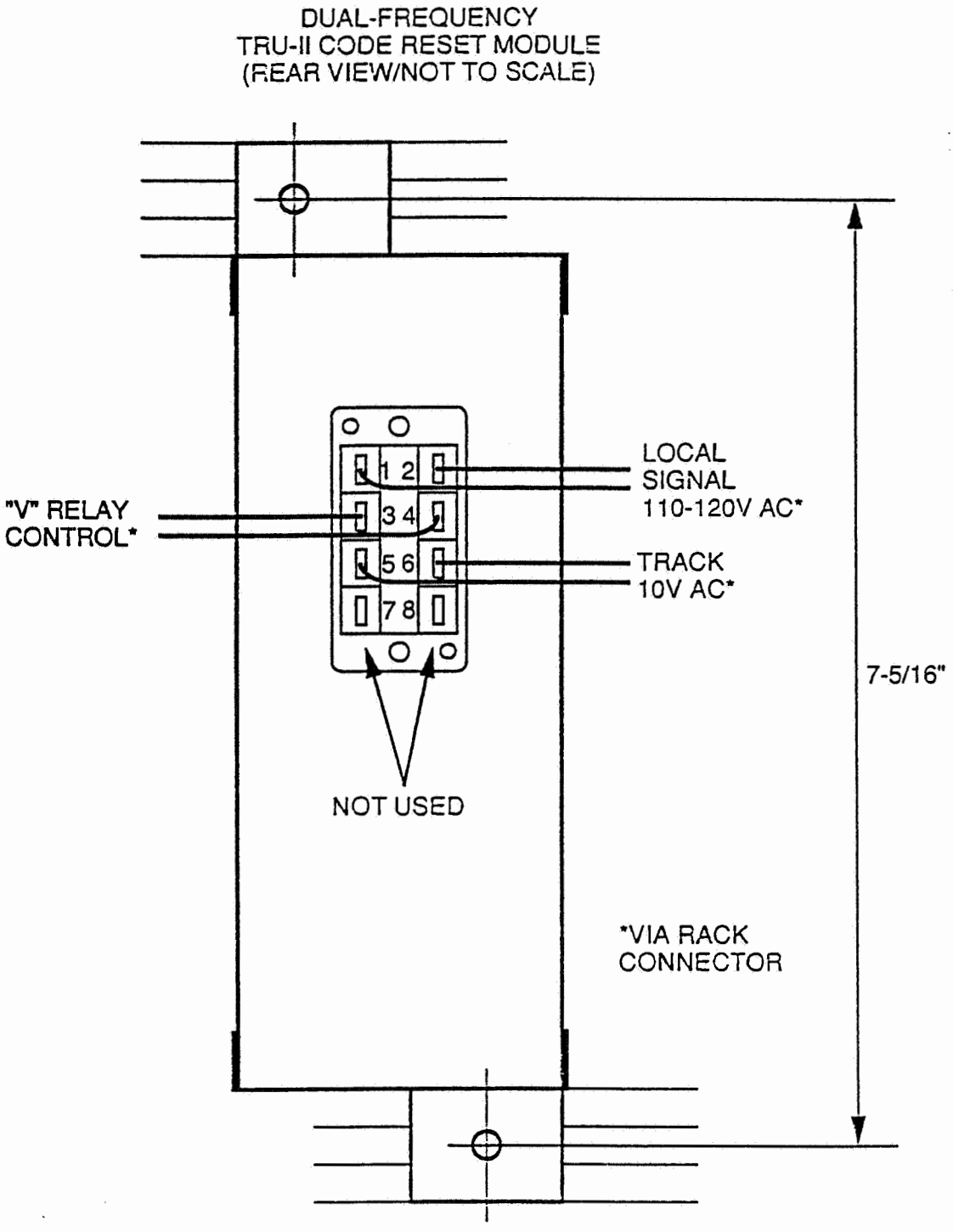


Figure 2-1. Installation Diagram

SECTION III
FUNCTIONAL DESCRIPTION
(See Figure 3-1)

3.1 GENERAL (See Figure 3-1)

The Dual-Frequency TRU-II Code Reset Module is designed to take its signal input from the tracks in parallel with the TRU-II Track Resonant Unit. The local input is only used for internal power. Track relay no. 1 back contact is connected in series with the reset module input in order to disconnect the source during steady energy track conditions. When a train shunts the normally steady energy track circuit, the no. 2 track relay back contact connects the B12 source to the "V" relay by way of the RRP back contact and traffic control circuits.

The "V" relay connects the source (100 Hz and 250 Hz coded energy) to the track input. When the train vacates the track circuit, the track system must be reset to the steady energy mode. The reset is accomplished by the reset module which, after several 100 Hz or 91.67 Hz code cycles, picks up the RRP relay. The "V" relay stick circuit is released and the source is switched back to steady energy, permitting the TRU-II to pick up.

NOTE

> The Dual-Frequency TRU-II Code Reset Module is not considered "vital" since resetting code to steady energy is not a vital function. The TRU-II Track Resonant Unit provides the required steady energy pick-up.

3.2 DETAILED (See Figure 3-2)

The Dual-Frequency TRU-II Code Reset Module accepts 91.67 and 100 Hz input signals from the W-400 track transformer at pins 6 and 7. The nominal input signal level is about 10V ac RMS. A series-tuned filter, consisting of C4 and L23 is connected in series with the input to transformer T2. A second series-tuned circuit, consisting of C3 and L1, is connected to the secondary of transformer T2 in series with the PC board lead. Under minimum input signal of 9V ac RMS, transformer T2 operates as a normal transformer device. When the input increases above this minimum level, T2 begins to saturate, thus limiting the amplitude of the signal. The C3/L1 filter tunes out the harmonics created by the saturable transformer action.

In addition to providing amplitude limiting for in-band signals (91.67 and 100 Hz), T2 also provides amplitude limiting for 25 Hz and 60 Hz propulsion frequencies. The amplitude limiting level at 60 Hz is about 60% of the 100 Hz limiting level, while the limiting level at 25 Hz is about 25% of the 100 Hz limiting level. The 250 Hz signal frequency is also limited by the combination of filters and saturable transformer. The two series-tuned circuits are stagger-tuned to provide a wide bandwidth for dual frequency and high code rate operation.

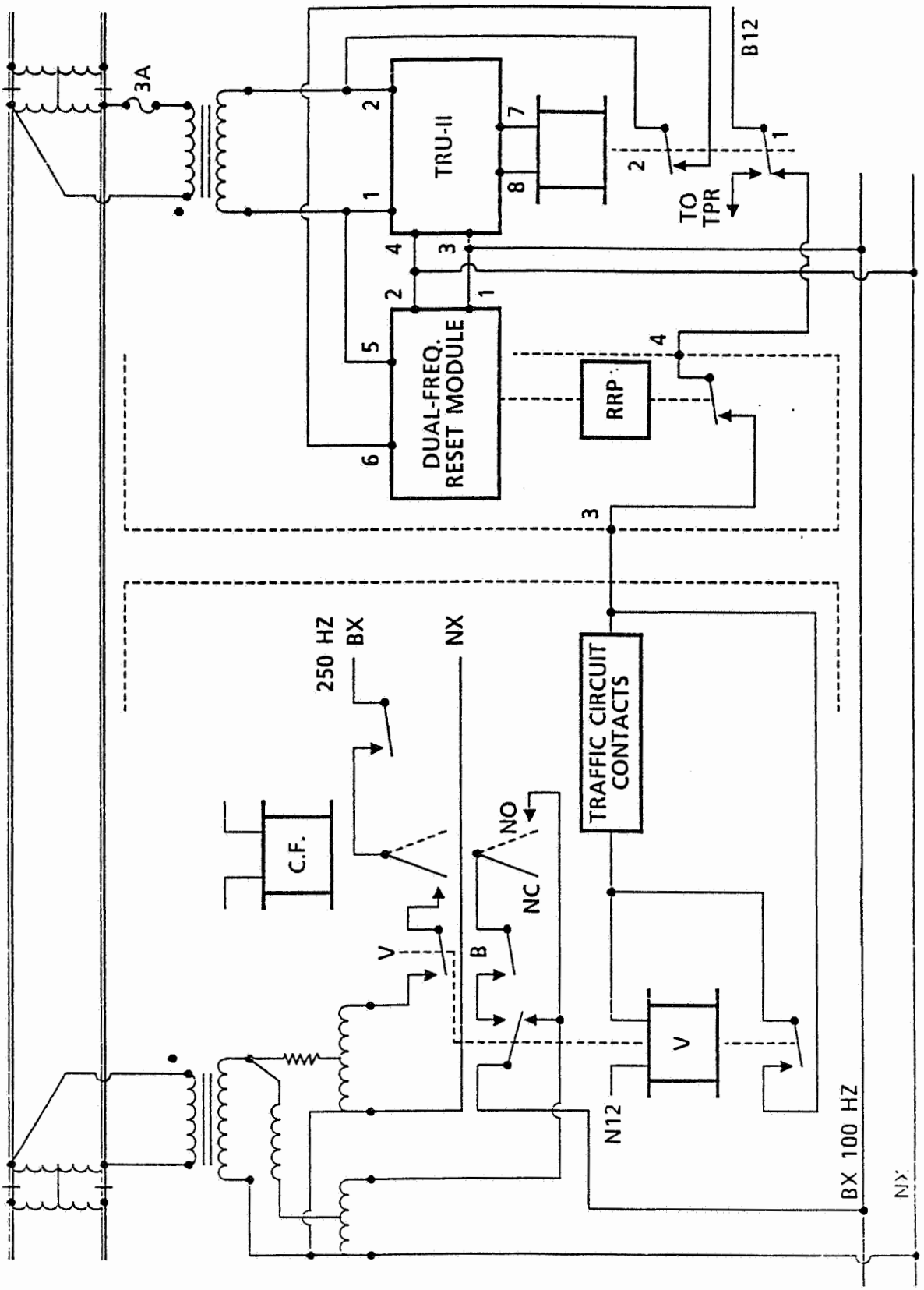


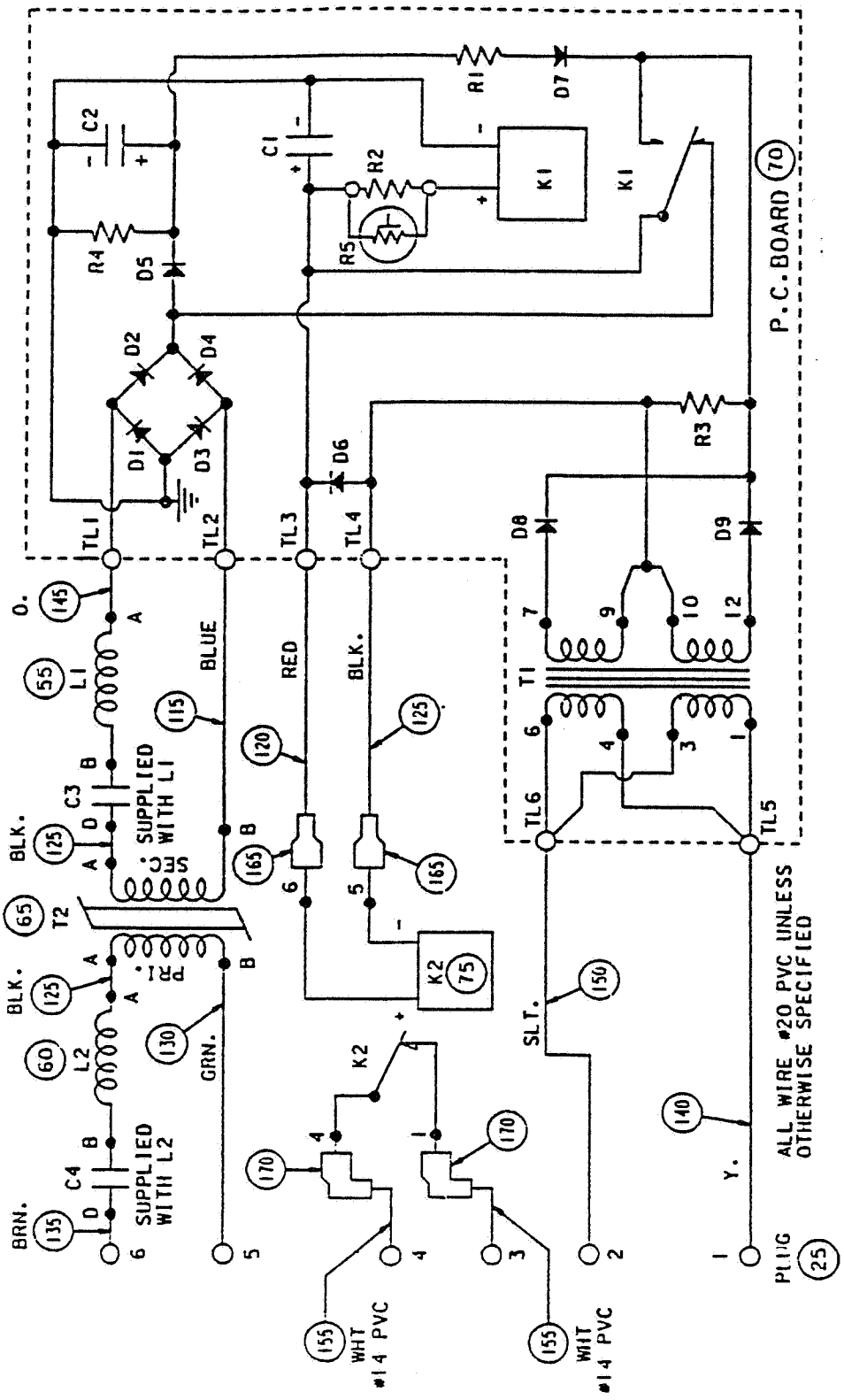
Figure 3-1. System Application Diagram

The filters-transformer combination output signal is connected to terminals 1 and 2 of the PC board, where it is full-wave rectified via diodes D1, D2, D3 and D4. DC output pulses charge capacitor C2 (4,700 uF) through steering diode D5. Resistor R4 (27K) provides a high impedance discharge path for C2. The output of the full-wave rectifier also charge capacitor C1 (47 uF) via the back contact of mercury-wetted reed relay K1. Capacitor C1 has a series-connected 685 ohm relay coil, resistor R2 and parallel combination of R5 and R6 as a fixed, relatively fast discharge path.

When 91.67 or 100 Hz code pulses are applied, several seconds are required before relay K1 can pick up, due to the charge time of capacitor C2. When K1 picks up, C1 provides the relay coil feed over the contact transfer time. When the K1 front contact is made, the relay feed circuit has steering diode D7 and an additional resistor (R1) connected in series with its coil. This action increases the reset module's input impedance to about 1K ohm. The K1 relay remains energized since the release voltage level is considerably below the pick-up voltage.

Relay K2 is a power relay repeater of K1. It is powered by the local 115V ac, 91.67 or 100 Hz input to PC board terminals 5 and 6. Transformer T1, in conjunction with diodes D8 and D9, make up and unfiltered 12v dc power source for the relay. Resistor R3 is a 680 ohm device. The output from this dc supply is fed through the front contact of K1 to the K2 repeater relay. Diode D6 is a relay coil snub.

PC board resistors R1 and R2 are shown as TBD (to be determined) for adjustment purposes due to variations in manufacturing specifications for K1. Thermistor R5 and parallel resistor R6 are for relay temperature compensation.



NOTE: BALLOON CALL-OUTS REFER TO PARTS LIST, SECTION A.1

Figure 3-2. Reset Module Schematic Diagram

SECTION IV
MAINTENANCE AND TEST PROCEDURES

4.1 GENERAL

Initial checks of the Dual Frequency TRU-II Code Reset Module consist of observing the track relay pick-up during code reset. A module suspected of being defective should be replaced with one known to be in working order. If a module is found to be defective, it should be given the shop troubleshooting and repair procedures in section 4.3, or returned to US&S for repair or replacement. Call 1-800-652-7276 for factory service information. No attempt should be made to repair the module in the field.

WARNING

EXTREME CARE SHOULD BE EXERCISED DURING "POWER ON" TESTS OF THE DUAL-FREQUENCY TRU-II CODE RESET MODULE. CONTACT WITH TERMINALS MAY RESULT IN PERSONAL INJURY.

4.2 FIELD CHECKS

Since the reset module is always used with TRU-II (code overlay applications), its operation can be verified as part of the TRU-II system field check.

4.2.1 Recommended Test Equipment

Device	Specifications/Recommended Model
Multimeter (qty = 1):	20,000 ohm/volt (e.g. Simpson 260 or equivalent)

4.2.2 Procedure

1. Check that the reset module and associated equipment are properly installed, including condition and tightness of all terminal connections.

2. Measure voltage across reset module input socket terminals 1 and 2. Voltage should always be steady energy in the 110 to 120V ac RMS range (approx.)

3. To test the reset module itself, shunt its associated track circuit. At this time the track feed should shift from steady energy to a coded energy mode. On release of the shunt, the track relay should energize after a 6 to 10 second delay.

4.3 OPERATIONAL SHOP TESTS

NOTE

The shop tests given in this section must be performed on all Dual-Frequency TRU-II Code Reset Modules suspected of having an internal fault, before these units can be returned to service.

4.3.1 Recommended Test Equipment and Set-Up

Device	Specifications/Recommended Model*
Oscillator (qty = 1):	Wavetek Model 146
Oscillator (qty = 1):	Wavetek Model 115
Amplifier (qty = 1):	Macintosh Model 2100
Frequency Meter (qty = 1):	Hewlett Packard 5300 Measuring System
Frequency Counter (qty = 1):	Hewlett Packard 5307A Counter
Digital Multimeter (qty = 1):	Fluke 8000A
Track Transformer (qty = 1):	US&S W-400 (part no. N451428-0104)
Reed Relay (qty = 1):	24 volt, Clare #HGJM51111T00 or US&S part no. J726153-0067
Diodes (qty = 2):	1N4004
Toggle Switch (qty = 1):	S.P.S.T.
Resistor (qty = 1):	1K ohm, 25 watt
Decade Resistor Boxes (qty = 2):	±3%, Cornell Dublier
Control Transformer (qty = 1):	24 volt
Light Bulb with Base (qty = 1):	24 volt
Breakdown Voltage Tester:	Highpot Junior

See Figure 4-1 for the set up of this test equipment.

*Or equivalent

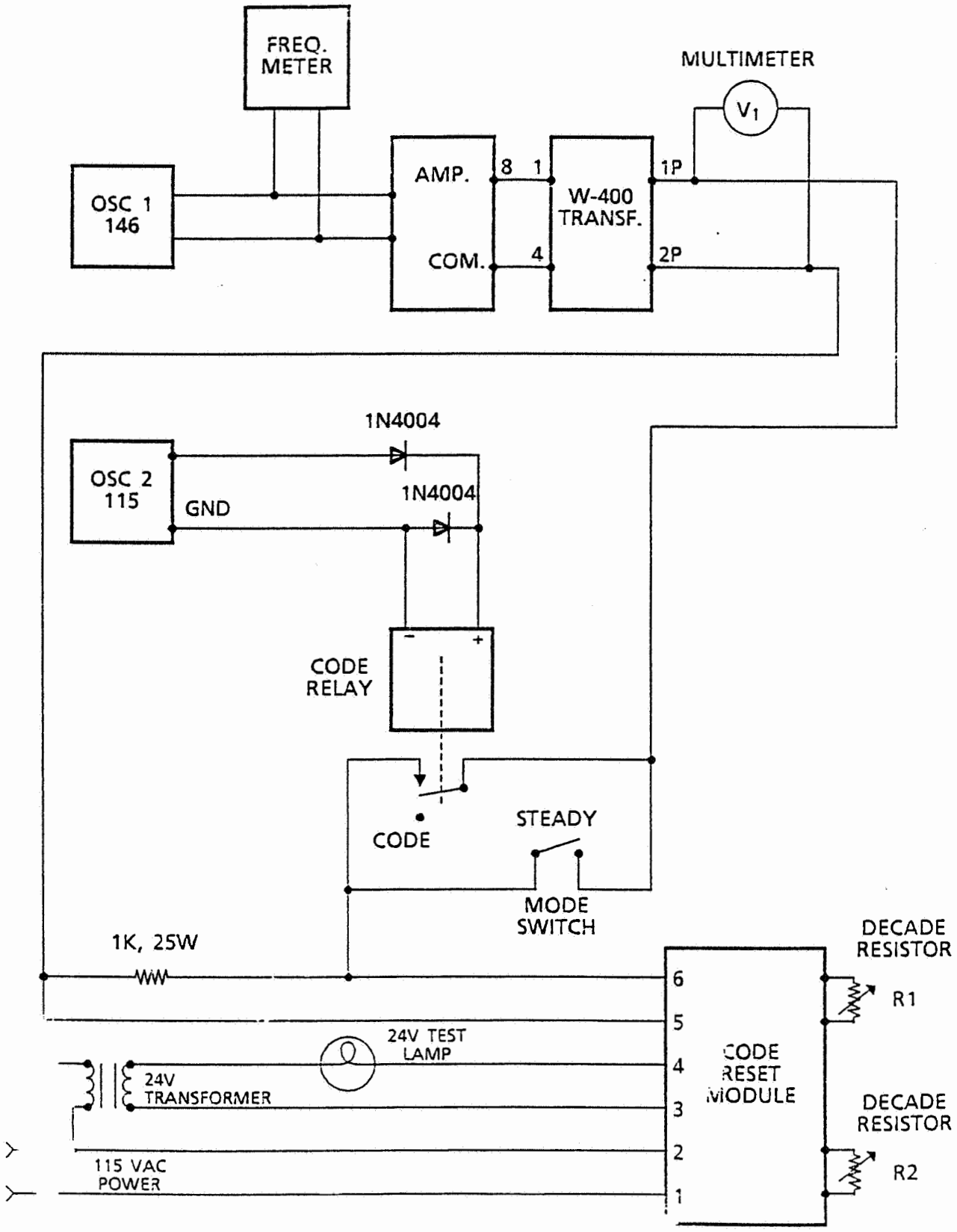


Figure 4-1. Operational Shop Test Set-Up

4.3.2 Test Procedure

NOTE

This procedure makes reference to two different versions of the reset module internal PCB: Rev. 1 or Rev 2 and above ("Rev. 2+"). Make note of the revision number on the board before conducting these tests.

Operation	Verification
1. Connect the reset module into the test circuit as shown in Figure 4-1. Notes: Make sure the reset module and the code relay are in the upright position. Decade resistors R1 and R2 only apply to Rev. 2+ PCBs. **Note: Steps 1A through 1K are for the Rev. 2+ PCB only.**	1. --
1A. Set the MODE switch to steady.	1A. --
1B. Adjust the amplifier so that V1 reads 0.00 Vac RMS.	1B. --
1C. Set oscillator no. 1 to 100 Hz and oscillator no. 2 to 7 Hz (420 code).	1C. --
1D. Set decade resistor R1 to 510 ohms and decade resistor R2 to 100 ohms.	1D. The test light should turn on.
1E. Adjust the amplifier output so that multimeter V1 reads 8.4V ac RMS.	1E. --
1F. Adjust decade resistor R2 to a value that allows the internal power relay to pick up at the 8.4V ac input level.	1F. The test light should turn off.
1G. Remove the R2 decade box and solder in equivalent 1/2W (±5%) carbon resistor in its place. Note: If the 8.4V ac pick-up cannot be achieved at R2 = 0.0 ohms, replace K1 on the PCB.	1G. --

Operation	Verification
1H. Adjust the amplifier output so that multimeter V1 reads 5.9V ac	1H. The power relay should release and the test light should turn on.
1J. Adjust decade resistor R1 so that the release occurs at 5.9V ac input. Note: The release adjustment can only be checked after the relay has been picked up.	1J. --
1K. Remove the R1 decade box and solder in an equivalent 1/2W, ±5% carbon resistor in its place.	1K. --
2. Set the MODE switch to steady.	2. --
3. Adjust amplifier so that V1 reads 0.00V ac RMS.	3.
4. Set oscillator no. 1 to 91.67 Hz and oscillator no. 2 to 7 Hz (420 code).	4. The test light should be on.
5. Adjust the amplifier output so that multimeter V1 reads 9.0V ac RMS.	5. The internal power relay should pick up and the test light should turn off.
6. Set oscillator no. 1 to 250 Hz and adjust the amplifier output so that V1 reads 125V ac RMS.	6. The test light should remain on.
7. Set oscillator no. 1 to 60 Hz and adjust the amplifier output so that V1 reads 150V ac RMS.	7. The test light should remain on.
8. Set oscillator no. 1 to 100 Hz and adjust the amplifier output so that V1 reads 9.0V ac RMS.	8. The test light should turn off.
9. Adjust the amplifier for a minimum level.	9. The test light should turn on.
10. Adjust the MODE switch to the code position.	10. --
11. Adjust amplifier so that V1 reads 9.5V ac RMS.	11. The test light should turn off after a delay of several seconds.

4.4 COMPONENT SHOP TESTS

4.4.1 General

Tests on individual subassemblies and components of the Dual-Frequency TRU-II Code Reset Unit requires removing the cover and all external connections. Make certain during reassembly that all parts and wiring connections are returned to their correct locations.

NOTE

When reassembly is complete, the unit must be given the operational shop tests described in section 4.3, before the unit is returned to service.

4.4.2 Series-Tuned Circuits Test

4.4.2.1 Recommended Test Equipment and Set-Up

Device	Specifications/Recommended Model*
Digital Multimeter (qty = 1):	Fluke 8000A
Oscillator (qty = 1):	Wavetek Model 200AB
Amplifier (qty = 1):	Macintosh Model 2100
Frequency Counter (qty = 1):	Hewlett Packard 5307A Counter
Oscilloscope (qty = 1):	2-channel, Tektronix 434
DC Ohmmeter (qty = 1):	--
Decade Resistor Box (qty = 1):	±3%, Cornell Dublier

See Figure 4-2 for the set up of this test equipment.

*Or equivalent

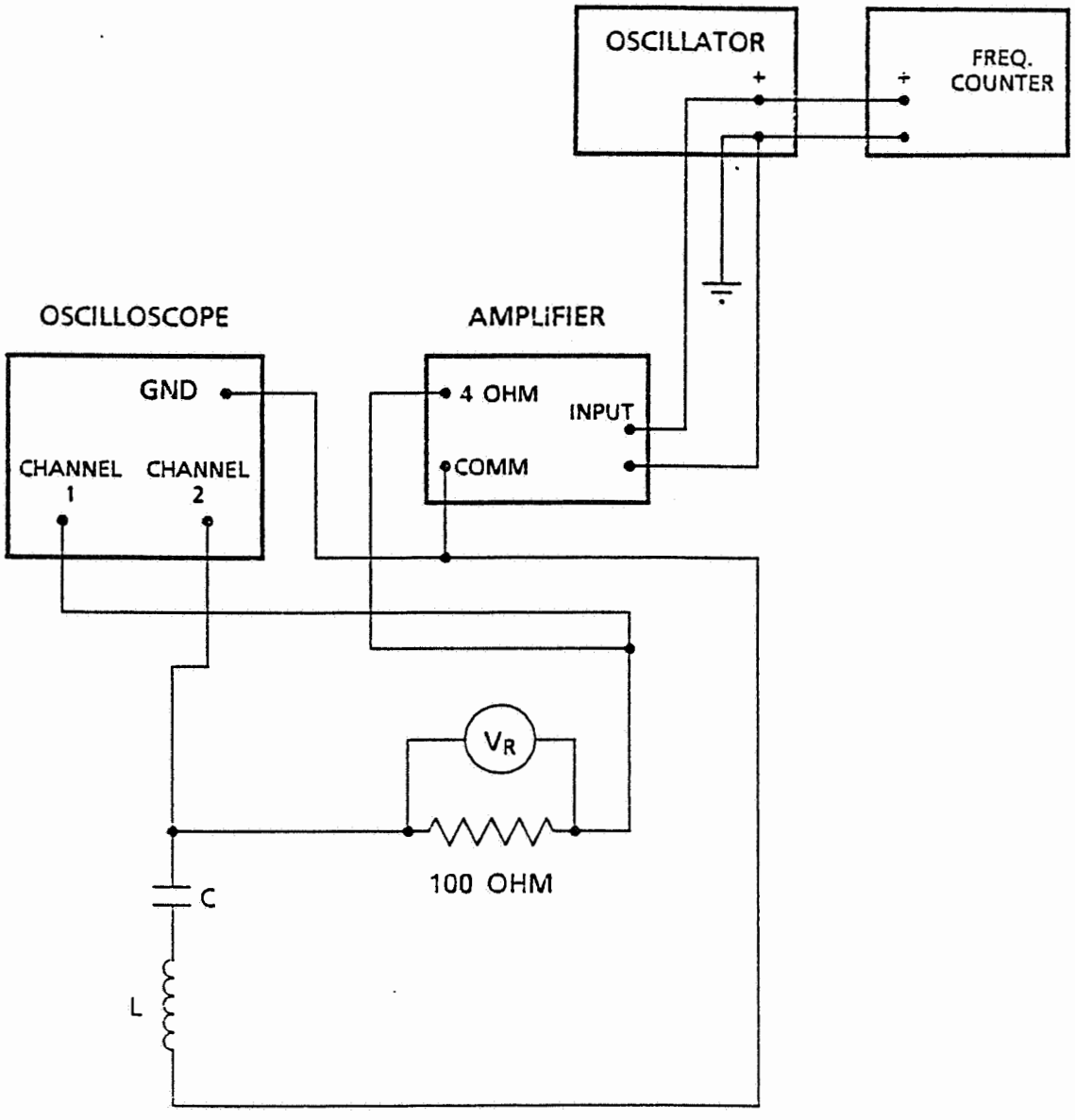


Figure 4-2. Series Tuned Circuit Test Set-Up

4.4.2.2 Test Procedure

Operation	Verification
1. Measure the inductor's dc resistance value and compare it to the value listed in Table 4-1.	1. --
2. To perform an operational test on a tuned circuit (inductor-capacitor combination), electrically isolate the circuit by disconnecting the lead wire on bobbin tab A and connecting the tuned circuit into the test circuit shown in Figure 4-2.	2. --
3. With oscilloscope inputs set for dc input signals, adjust the vertical traces so that their ground levels are on the middle horizontal line.	3. --
4. Adjust the input signal (channel 1 scope) to about 6.0V P-P.	4. --
5. Adjust the frequency to the value shown in Table 4-1.	5. --
6. Adjust the input signal so that multimeter V_R reads 1.00V ac RMS. During the tuning period, maintain this 1.00V ac RMS level.	6. --
7. Adjust the oscillator frequency so that the oscilloscope traces appear as shown in Figure 4-3. Note: If an inductor or capacitor is found to be defective, both must be replaced because they are assembled and tested as a matched pair.	7. --

Table 4-1. Series-Tuned Circuit Test Values

Filter N451039-	Coil Resistance (Ohms)		Tuning Point LC Network Freq. (Hz)		Signal Levels	
	Min.	Max.	Min.	Max.	V_R Volts AC RMS	Scope CH 2 Output, Volts P-P
5701 92 Hz L1, C3	28.0	29.0	91.8	92.5	1.00	2.00
5702, 103 Hz L2, C4	28.0	29.0	102.8	103.5	1.00	1.30

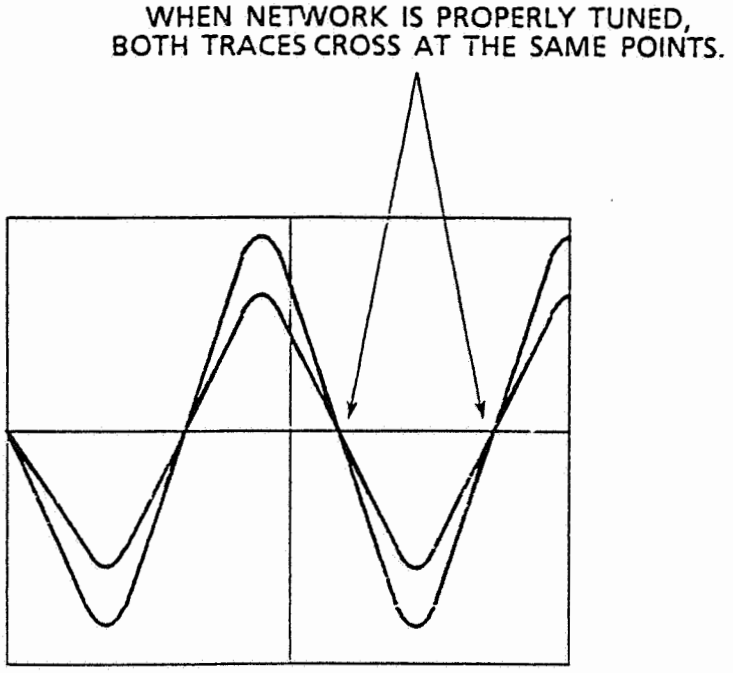


Figure 4-3. Series-Tuned Test - Oscilloscope Waveform

4.4.3 Transformer Test

4.4.3.1 Recommended Test Equipment and Set-Up

Device	Specifications/Recommended Model*
Oscillator (qty = 1):	Wavetek Model 146
Frequency Counter (qty = 1):	Hewlett Packard 5307A Counter
Amplifier (qty = 1):	Macintosh Model 2100
Decade Resistor Boxes (qty = 2):	±3%, Cornell Dublier
Oscilloscope (qty = 1):	2-channel, Tektronix 453
Digital Multimeter (qty = 1):	Fluke 8000A

See Figure 4-4 for the set up of this test equipment.

*Or equivalent

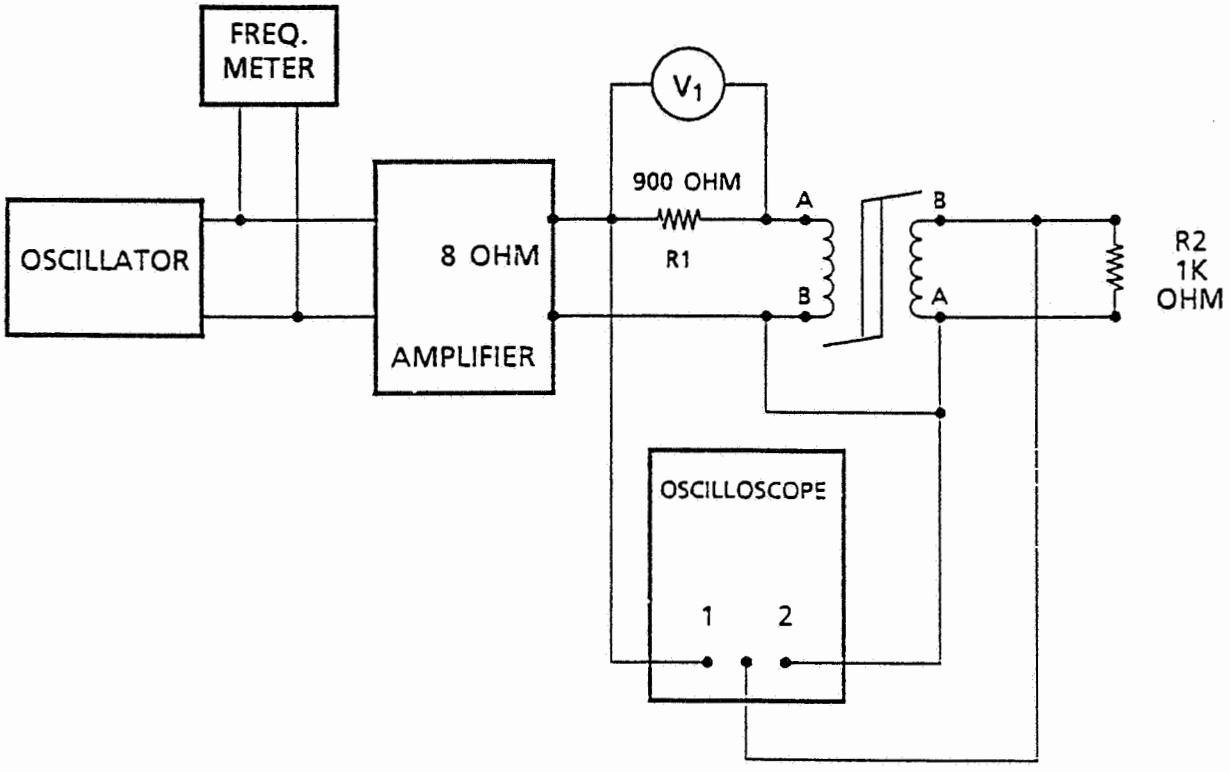


Figure 4-4. Transformer Test Set-Up

4.4.3.2 Test Procedure

Operation	Verification
1. Measure the transformer primary and secondary coil resistances.	1. Resistances should read within a range of 2.47 to 2.70 ohms.
2. To perform an operational test on transformer T2, electrically isolate it by disconnecting the orange wires to PCB turret lug no. 1. The connect the transformer to the test circuit shown in Figure 4-4.	2. --
3. Adjust the frequency to 100 Hz.	3. --
4. Adjust the amplifier output level so that multimeter V1 reads 9.00V ac RMS (10 mA input current).	4. --
5. Adjust oscilloscope channel 1 to 10 volts/cm and channel 2 to 5 volts/cm. Set the time/div. to 1.0 msec. per division.	5. Channel 1 should read 49 to 51 volts P-P. Channel 2 should read 24.5 to 25.5 volts P-P. Channel 2 waveform should lead channel 1 waveform by 0.2 to 0.3 msec. as shown in Figure 4-5.

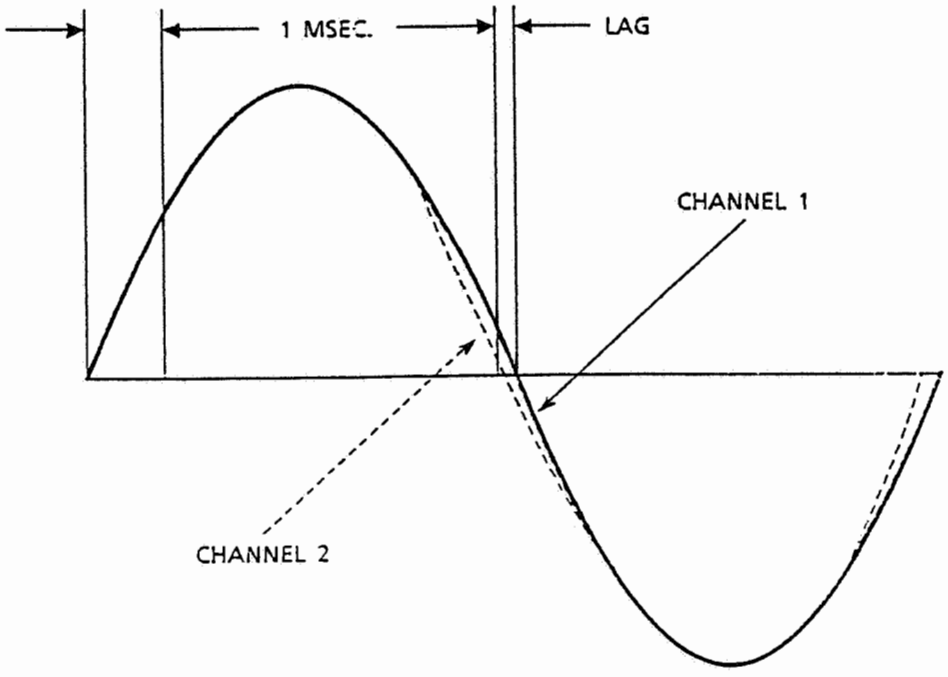


Figure 4-5. Transformer Test - Oscilloscope Waveform

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APPENDIX A
PARTS LIST

Dual-Frequency
TRU-II Code Reset Module

N451206-0301

August, 1993
A-a/93-3012
P&C MAC-II 6237A

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A.1 COMPLETE ASSEMBLY N451206-0301 (See Figure A-1)

ITEM	DESCRIPTION	US&S PART NO.	NOTES
10	Cover	N451207-1202	
15	Body	N451207-1701	
20	Mounting Plate (Body)	N451207-1906	
25	Plug	J071878	
30	Nameplate	M451496-8503	
35	Screw, #2 x 1/4" Round Head	J525007	
40	Screw, #8-32 x 3/8" Pan Head	J050985	
45	Washer, #8 Lock	J047681	
50	Nut, #8-32 Hex	J048166	
55	Reactor	N451039-5701	
60	Reactor	N451039-5702	
65	Transformer	N451039-4104	
70	Reset Printed Circuit Board	N451807-7601	1
75	Relay	J726153-0157	
80	Screw, #4-40 x 1/4" Pan Head	J507297-0104	
85	Washer, #4 Lock	J047765	
90	Screw, #10-32 x 3/8 Pan Head	J507266	
95	Washer, #10 Lock	J047733	
100	Washer, #10 Flat	J475077	
105	Nameplate	M451108-5202	
110	Pop Rivet	J490029	
115	Wire, #20 PVC Blue	A045505-0002	
120	Wire, #20 PVC Red	A045505-0006	
125	Wire, #20 PVC Black	A045505-0001	
130	Wire, #20 PVC Green	A045505-0004	
135	Wire, #20 PVC Brown	A045505-0003	
140	Wire, #20 PVC Yellow	A045505-0009	
145	Wire, #20 PVC Orange	A045505-0005	
150	Wire, #20 PVC Gray	A045505-0007	
155	Wire, #14 PVC Gray	A045519-0005	
160	Tie Wrap	J703302	
165	Terminal	J731476	
170	Terminal, Right-Angle	J731399-0073	
175	Plate, Mounting (Base)	N451207-1102	
180	Terminal Post	M115706	
185	Washer, 3/16 Flat	J047500	
190	Nut, S14-24 AAR	J480301	
195	Clamp	M381298	
210	Screw, #6-32 x 1/2 Pan Head	J507022	
215	Washer, #6 Lock, Stainless Steel	J457121-0107	
220	Washer, #6 Flat	J047996	
225	Nut, #6-32 Hex	J048148	

NOTES:

1. Refer to section A.2 for component parts.

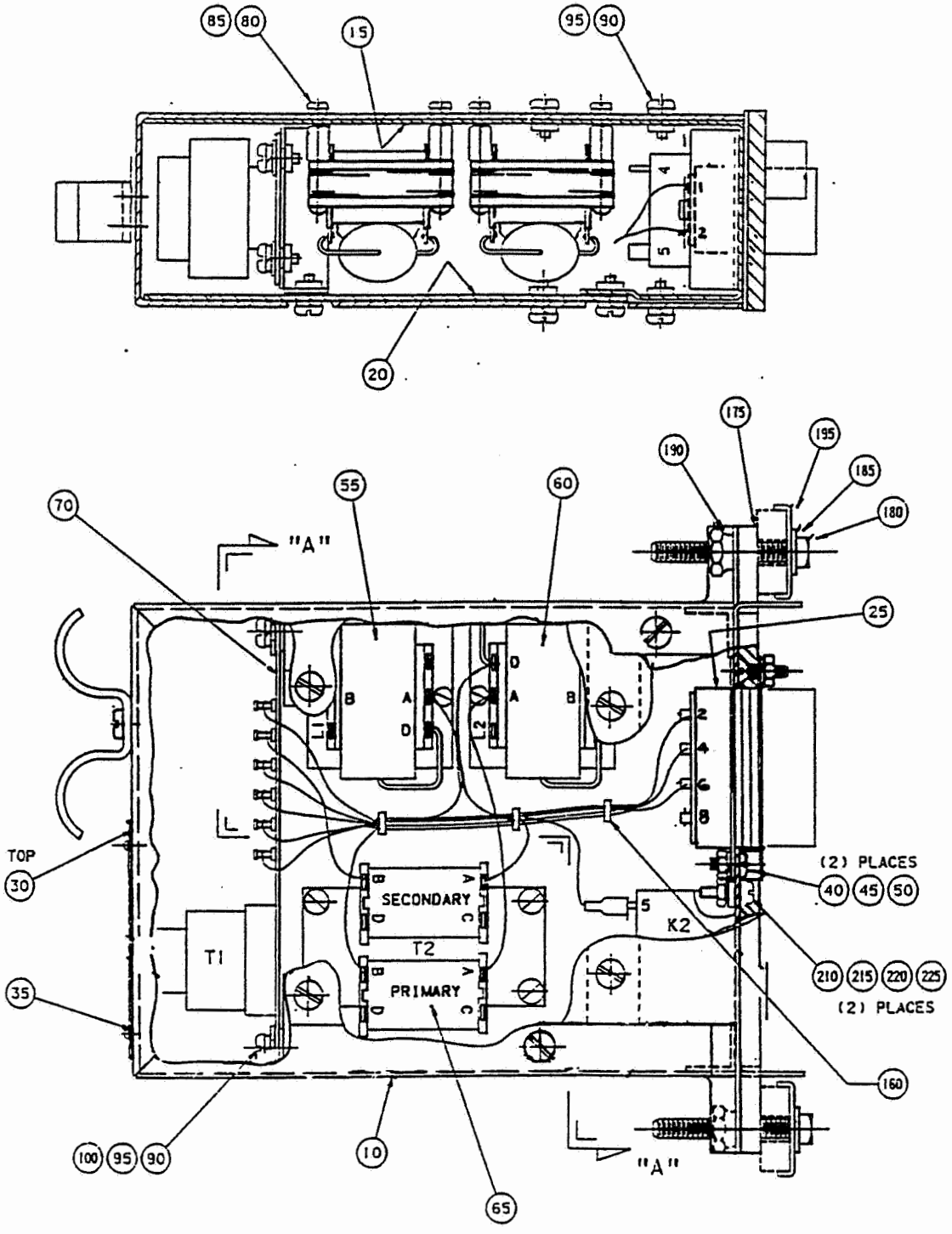
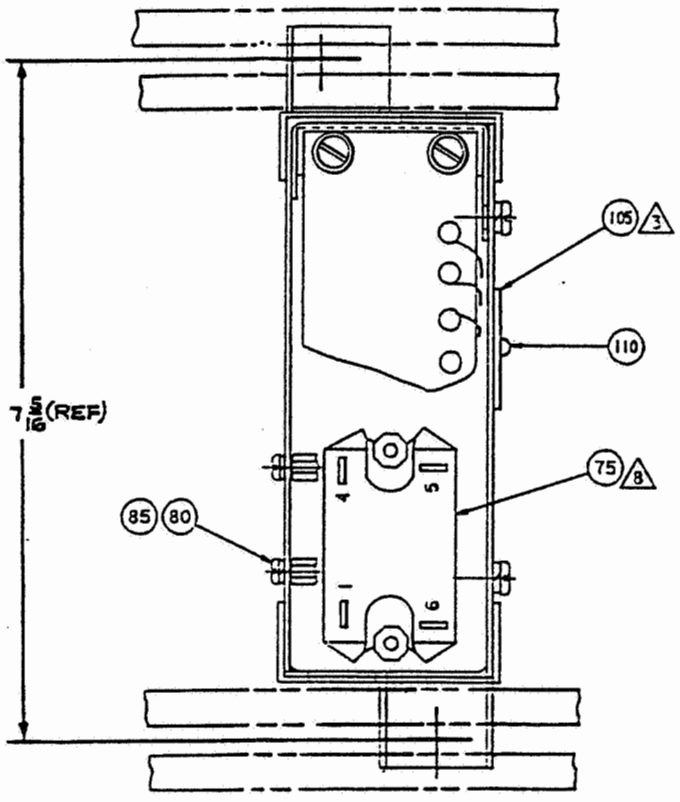


Figure A-1. Unit Complete Assembly



SECTION "A"-"A"

Figure A-1. Unit Complete Assembly (Cont'd)

A.2 RESET PCB N451807-7601 (See Figure A-2)

ITEM	DESCRIPTION	US&S PART NO.
C1	Capacitor, 47 mFd, 20V dc	J706254
C2	Capacitor, 4700 mFd, 16V dc	J709145-0857
K1	Relay, 12V dc, SPDT	J726153-0080
D6-D9	Diode, 1N4005, 600V	J723568
TL1-6, R1, R2, R6	Turret Lug	J714138
R1	Resistor (TBD)	--
R2	Resistor, 300 Ohm, 1/2 W	J721251
R3	Resistor, 680 Ohm, 1/2 W	J720773
R4	Resistor, 27K Ohm, 1/2 W	J720759
R5	Thermistor, 100 Ohm	J731405-0021
R6	Resistor (TBD)	--
T1	Transformer	J731400-0054
D1-D5	Diode	J726150-0274
--	Tie-Cable Clamp	J703372-0003

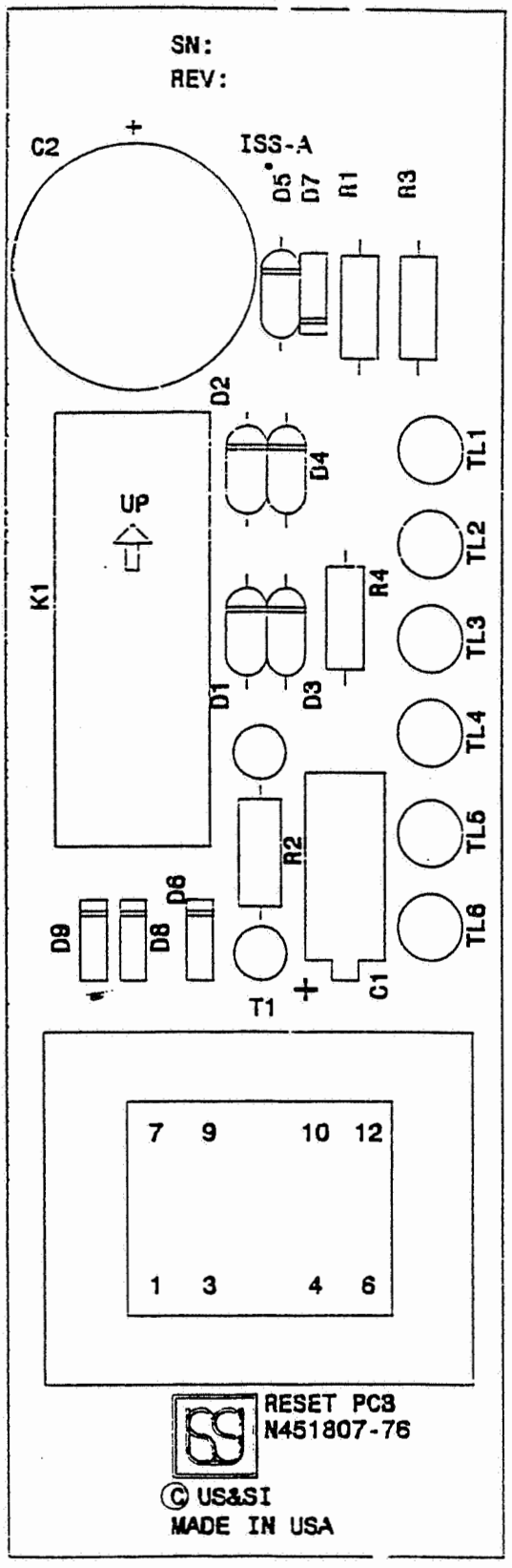


Figure A-2. Reset PCB Component Layout